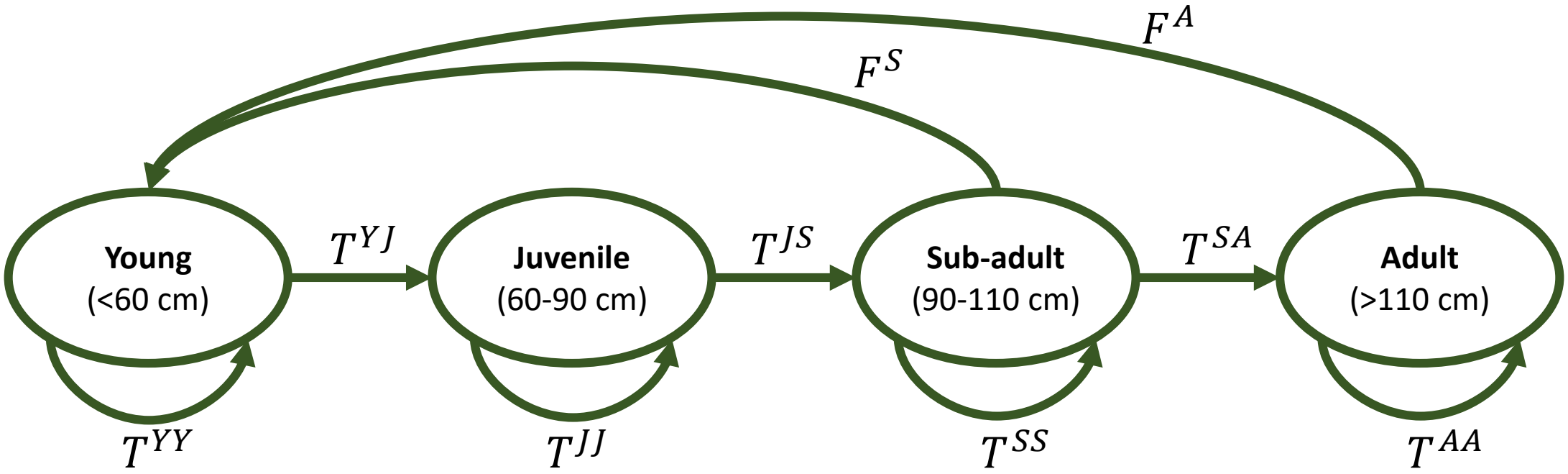
Puerto Rican boa

SSA projection modeling update

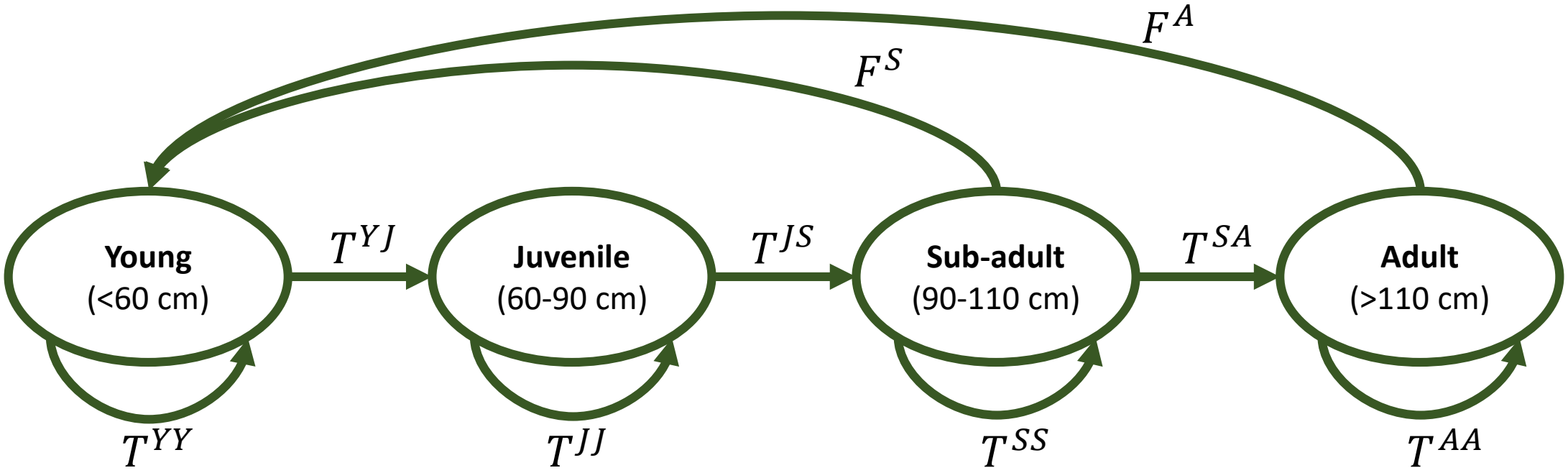
8 May 2019

Anna Tucker, Auburn University
Conor McGowan, USGS AL Cooperative Fish and Wildlife Research Unit

Life cycle diagram

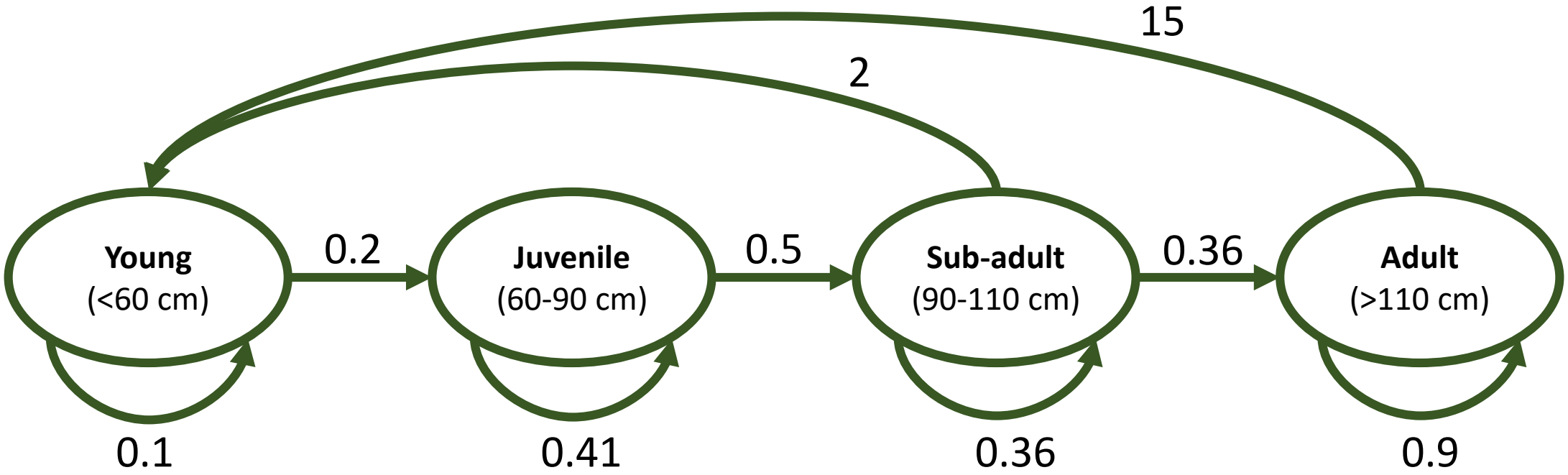


Life cycle diagram



$$\begin{bmatrix} N_t^Y \\ N_t^J \\ N_t^S \\ N_t^A \end{bmatrix} = \begin{bmatrix} \boldsymbol{T^{YY}} & 0 & \boldsymbol{F^S} & \boldsymbol{F^A} \\ \boldsymbol{T^{YJ}} & \boldsymbol{T^{JJ}} & 0 & 0 \\ 0 & \boldsymbol{T^{JS}} & \boldsymbol{T^{SS}} & 0 \\ 0 & 0 & \boldsymbol{T^{SA}} & \boldsymbol{T^{AA}} \end{bmatrix} x \begin{bmatrix} N_{t-1}^Y \\ N_{t-1}^J \\ N_{t-1}^S \\ N_{t-1}^A \end{bmatrix}$$

Demographic rates estimated by expert team



$$\begin{bmatrix} N_t^Y \\ N_t^J \\ N_t^S \\ N_t^A \end{bmatrix} = \begin{bmatrix} 0.1 & 0 & 2 & 15 \\ 0.2 & 0.41 & 0 & 0 \\ 0 & 0.5 & 0.36 & 0 \\ 0 & 0 & 0.36 & 0.9 \end{bmatrix} x \begin{bmatrix} N_{t-1}^Y \\ N_{t-1}^J \\ N_{t-1}^S \\ N_{t-1}^A \end{bmatrix}$$

Demographic rates estimated by expert team

- Experts did not give estimates of uncertainty (SE or confidence interval) or temporal variation
- Assumed ± 15% uncertainty in each parameter estimate
- Assumed that demographic rates would vary by ± 15% each year

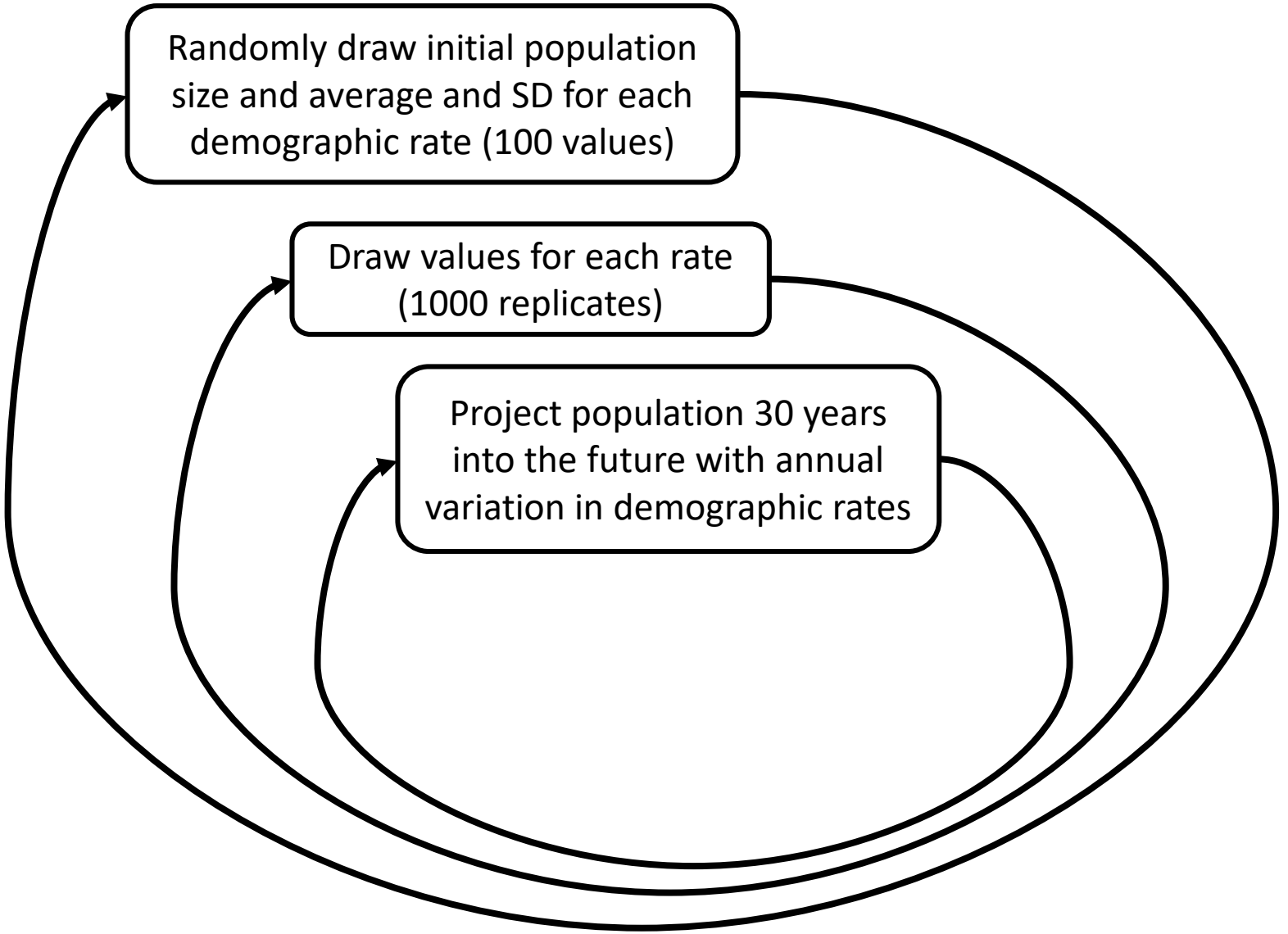
- No estimates of current total population size
  - We randomly drew an initial population size between 1,000 and 30,000

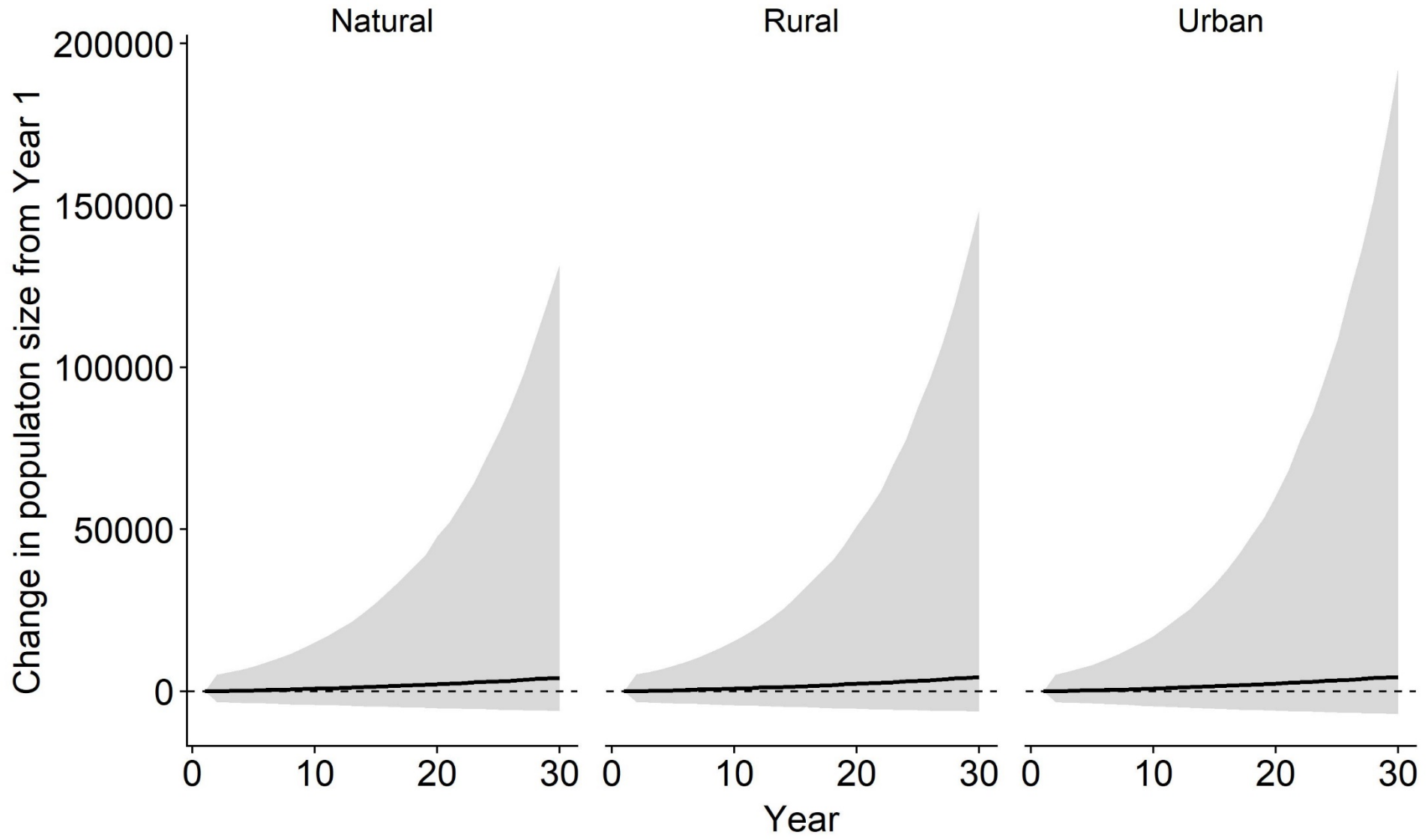
Differences in habitat types

- Included three habitat types: natural (undeveloped), rural (low development), and urban (high development)
- Assumed that all demographic rates would be more variable in developed areas than undeveloped areas (due to competing influences of increased mortality and increased prey availability)
  - Rural: ± 5% of natural habitat rates
  - Urban: ± 10% of natural habitat rates

- For initial projections, assumed that the population was equally distributed among these three habitat types

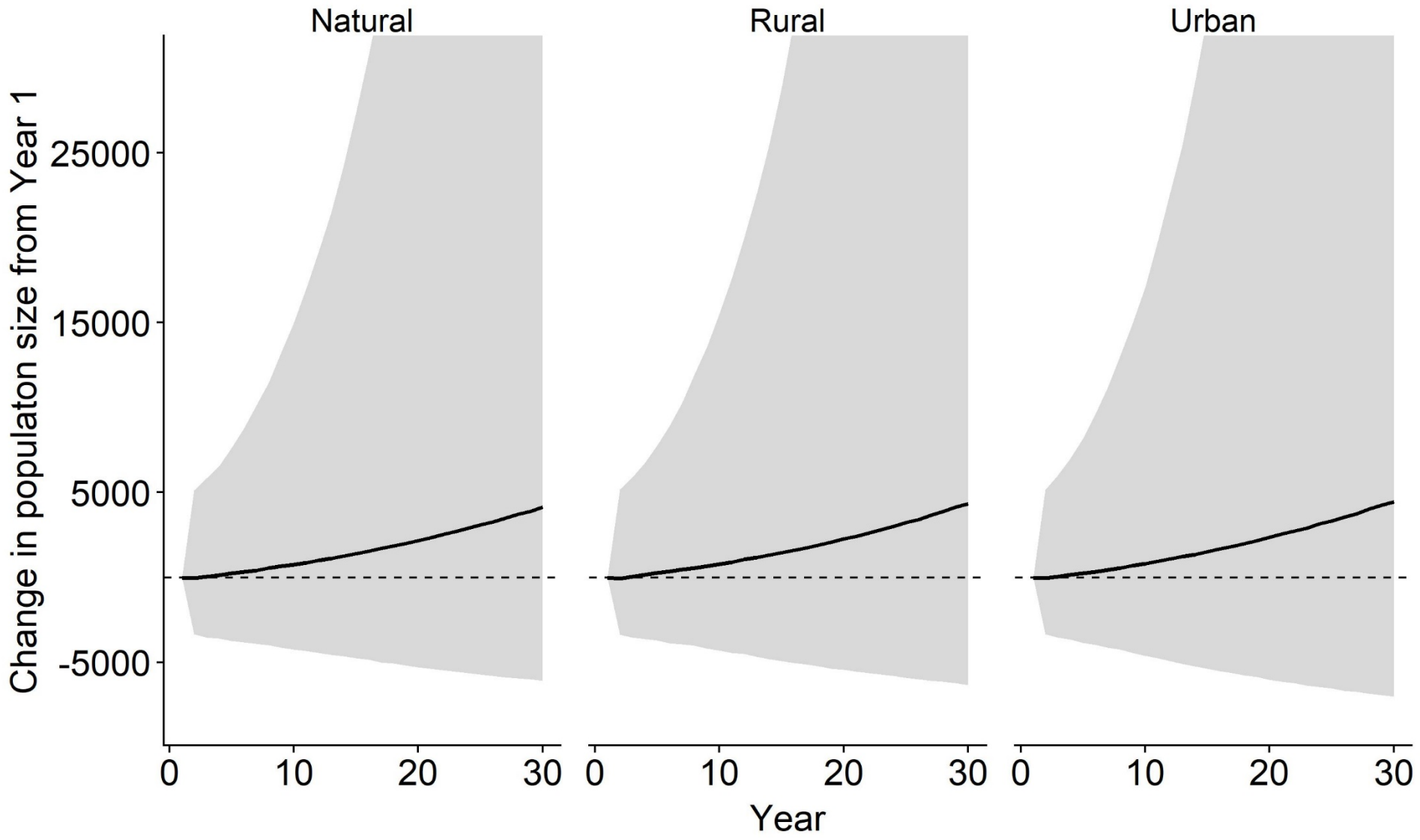
Projection model

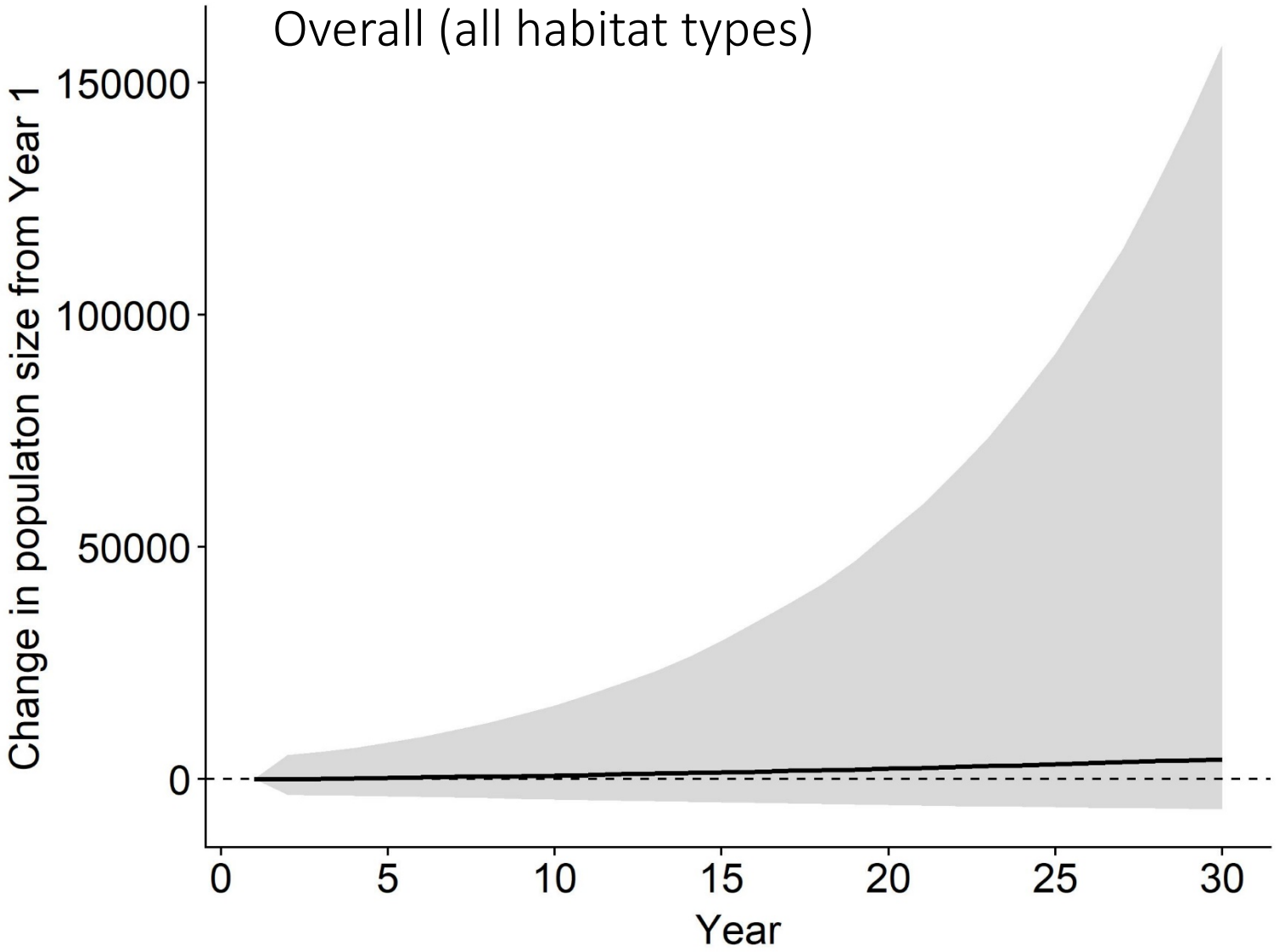




Projected change in total population size in each habitat type. The solid line is the median outcome from all replicates and the shaded region indicates the 95% upper and lower quantiles. Dashed horizontal line at zero indicates no population change.

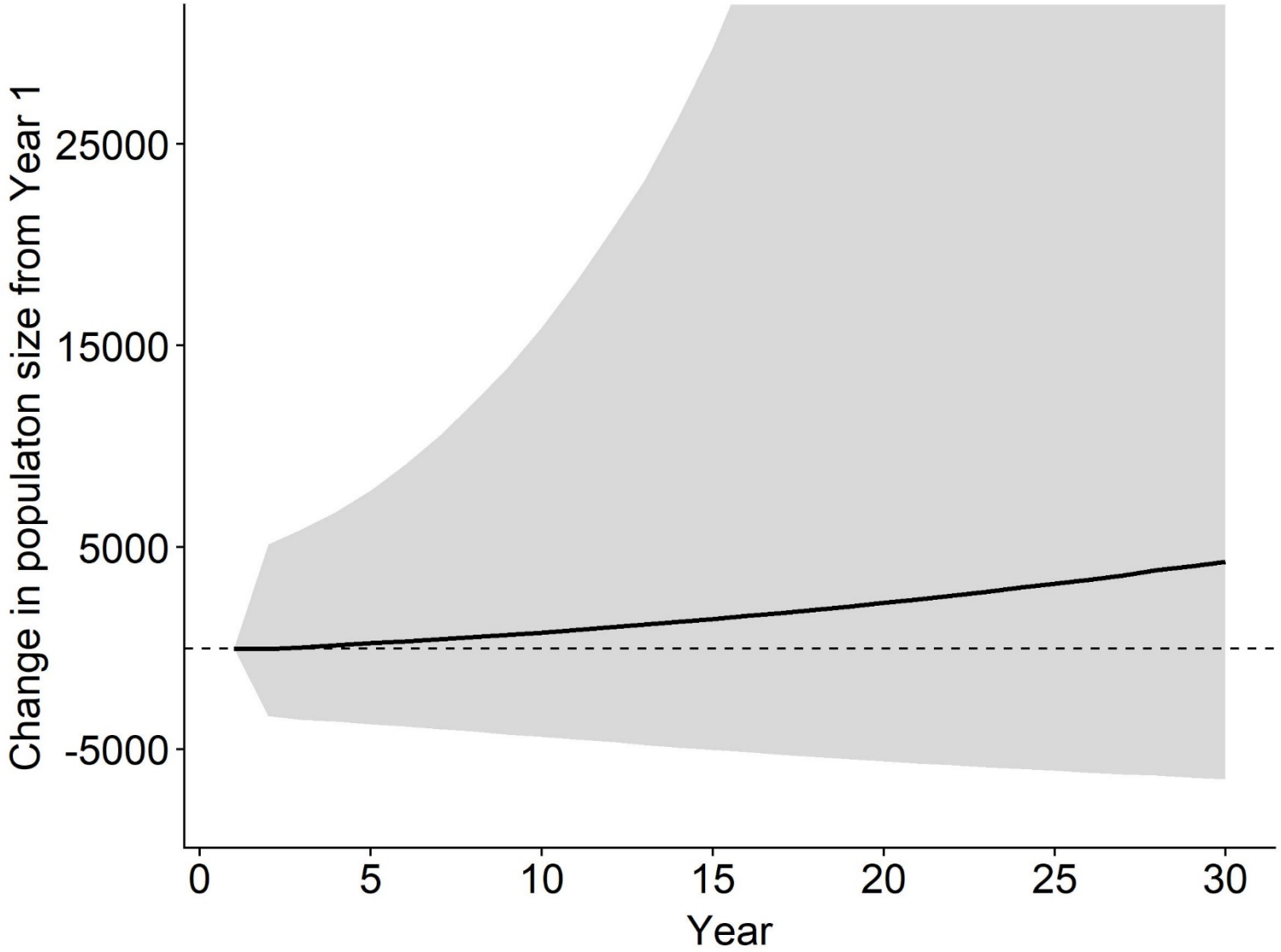
Zoomed in view of previous figure



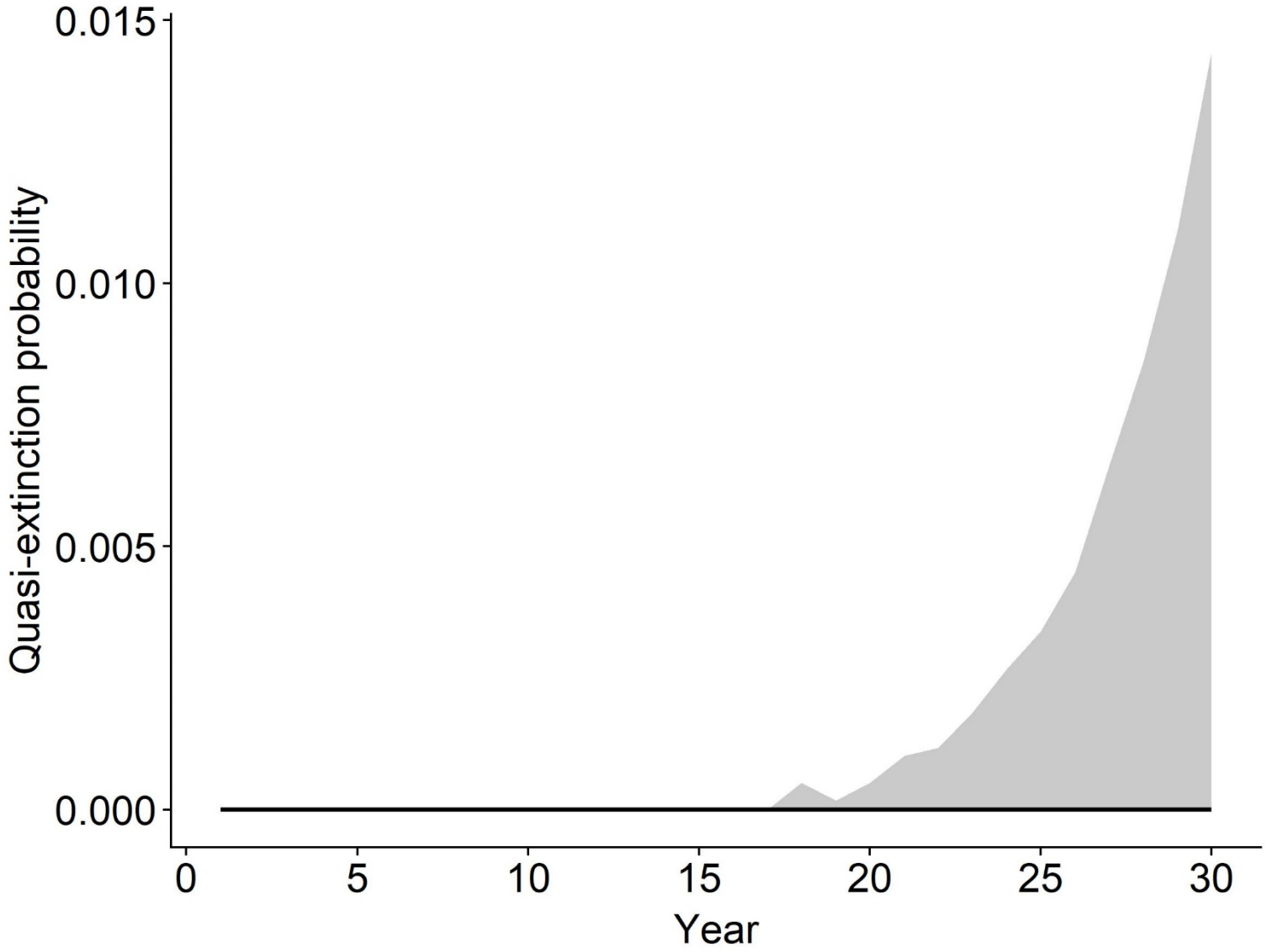


Projected change in total population size. The solid line is the median outcome from all replicates and the shaded region indicates the 95% upper and lower quantiles. Dashed horizontal line at zero indicates no population change.

Zoomed in view of previous figure



Quasi-extinction threshold = 50



Potential future scenarios

- Change in land cover
  - For example, increase the amount of urban, decrease natural
  - Use PR GAP land cover raster to determine current relative coverage of each habitat type
- Add severe storm events
  - Specify how severe weather impacts demographic rates (for example, 50% reduction in survival)
  - Specify frequency of storm events impacting each habitat type
- Impacts of invasive predators?
  - Implemented as an effect on survival probability of young and/or juveniles

Next steps

- Population ceiling?
- Estimates of current population size and/or occurrence
- Decide on future scenarios to implement